

THE MINING AND METALLURGICAL INDUSTRIES
OF LAURIUM

FOR

THE EXHIBITION OF CHICAGO U. S. AMERICA

BY

A. CORDELLA

GENERAL MANAGER OF THE GREEK METALLURGICAL
COMPANY OF LAURIUM



ATHENES

PRINTING OFFICES ALEXANDRE PAPAGEORGIOU

3. OFTHALMIATRIO STREET 3.

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A'.

EXHIBITION OF CHICAGO
THE MINING AND METALLURGIC
INDUSTRIES OF LAURIUM

Towards the East of Continental Greece, inland from where the Cape of Sounium stretches into the Aegian Sea, extends the various shaped hilly country of Laurium.

Minerals richly abound in this place, consisting of Mica-Slate and Marble. It has an area of about 20,000 hectares and contains minerals, of different kinds, viz; lead, silver, zinc and iron in abundance. These riches the ancients exploited and the moderns are utilizing now. The ancients principally exploited the lead and silver, leaving almost untouched the minerals, iron and zinc, because the use of the latter was unknown to them. The former they procured from other richer mines, existing in abundance in different parts of Greece. After working them for about three centuries, by nearly 15,000 slaves, they had extracted 2,100,000 tons of lead, mixed with silver, to the value of 4,171,000,000 fr.

(L. 166,840,000), while those of today profit not only from the mineral riches of the place, but also from the refuge of the ancient mines and metallurgical works.

In fact, on account of the imperfect means they then had, the Laurium mines were not exhausted, as the ancients thought. Besides that, they left waste heaps all about the place, then useless and valueless, but capable now to generously repay any who undertakes to use them. Thus remain to day not only minerals of iron and zinc, but also lead and silver and the waste heaps of the old Silver mines and metallic washings on the one hand, which now bear the name of ECBOLADES, and on the other the ancient SCORIES OR SLAGS of the Lead-Smelting and metallurgic works. The former are counted at 105,000,000 tons, each ton of which has in proportion 4—8 % of lead, while in each ton of lead there are 1000—1300 grs. of silver (ounces 32—41). But it is understood that hardly the $\frac{1}{10}$ of the above quantity can be extracted without great care—the latter, the scories or slags—was once counted at 1,515,107 tons, containing lead in proportion 10.5 %. Afterwards many other heaps were found either underneath the Ecvolades or in the sea. Therefore one can well reckon to day the sum of them to be about 2,500,000 tons¹.

The operations upon the Laurium mineral riches, which began at a very early period lasted untill the

¹ See A. Cordella «Greece examined geologically and mineralogically». page 115. (2) Le Laurium p. 21 par A. Cordella.

first century A.D. After that epoch desolation and silence reigned, in that place, which had once seen so much energy and life, and which supplied the Athenians with the means to resist and subdue the Asiatic enemy. Only towards the end of 1860, the moderns turned their attention to the yet remaining treasures. Then once again this desolate and abandoned place began to revive; the shafts and ancient exploitations were examined with extraordinary activity; necessary buildings were raised; roads and railroads were made, and the surroundings were colonized with, what may be called, American speed.

Twenty five years have hardly passed since then, and to day the fine and industrius town of Laurium numbers some thousands of inhabitants, of which 7000 are workmen. Electric lamps light up the furnaces and the Ore dressing departments. Railroads a metre wide and 100 miles long, unite different parts of the Laurium, country with the Capital. Hundreds of steamers enter every year into the two very safe ports of Laurium, that of Ergastiria and Thorico, transporting metals and metallurgical products to Europe and bringing thence coals e.c.t.

From the year 1864 to 1892 were produced:

- 1) 250,000 tons of argentiferous-lead with 1800 grs. of silver (ounces 57) in each ton of lead.
- 2) 550,000 tons of iron Ore of maganeze (till the end of December 1891).

3) 500,000 tons of Calamine (Smithsonite roasted) till the end of December 1894.

At the Mining and Metallurgical works of Laurium are the following companies:

A'.) The Greek Metallurgical company of Laurium, (Usines du Laurium) which employs a total of 2800 workmen.

B'.) The French Mining company of Laurium (Mines du Laurium) which employs 3800.

C'.) The French Mining company of Sounium, which has 100 workmen.

D'.) The metal Mines of Drossopoulo which have 300 workmen.

The yearly products of these companies, which have greatly increased during the last years are as follows:

■). 15,000 tons of argentiferous-lead from which:

A'.) The Greek Metallurgical company of Laurium, produced up to 8,000 tons with 1700—2500 grs. of silver (ounces 54—80) in each ton of lead.

B'.) The French Mining company of Laurium produced 7,000 tons with 1700 grs. (ounces 54) of silver in each ton of lead.

■■). 150,000—160,000 tons of iron Ore of Maganeze, from which produced:

A'.) The Greek Metallurgical company of Laurium 45,000 tons.

B'.) The French Mining company of Laurium 36,000 tons.

G'.) The French Mining company of Sounium 45,000 tons and

D'. The Drossopoulo mines 30,000 tons.

III). 30,000 tons of roasted Smithsonite from which extraced:

A'.) The Greek Metallurgical company of Laurium 2,000 tons.

B'.) The French Mining company of Laurium 26,000 tons, and

C'.) The French Mining company of Sounium 2,000 tons.

The above mentioned companies have the right to trade extract the silver lead, the iron Ore of Maganeze, and the zinc in the mines, working only underground. Only the Greek Metallurgical company of Laurium, besides this, has also the right to utilize all the Ecvolades and scories or slags, which are scattered on the ground of the Laurium country, as well as in the sea.



B.

DESCRIPTION OF EXHIBITS
OF THE GREEK METALLURGICAL
COMPANY OF LAURIUM

- 1). ANCIENT LAND SCORIES OR SLAGS (Barbaliaki).
- 2). ANCIENT SEA SCORIES OR SLAGS (Brysaki).
- 3). ANCIENT SEA SCORIES OR SLAGS CONGLOMERATED.
- 4). ANCIENT SCORIES WITH LEAD AND LITHARGE.
- 5). ANCIENT SCORIES WITH LAURIONITE.

These scories containing 8—13 % of lead, while each ton of lead contains 400—600 grs. (ounces 12—19). of silver, are smelted without any former preparation. They are often found in the sea, where they are drifted by the water, and whence they are dragged out by dredging machines or diving bells. Sometimes these sea scories are conglomerated with limestone and they contain lead in metallic state, or pieces of litharge with sea-shells between.

Number 5 scories or slags are extracted from a place

called Brysaki. They contain new mineral, much formed by the action of the sea water upon the metallic lead, and Galena (sulphate of lead) of the scories or slags, that is the LAURIONTE. This mineral appears in the form of small needlepointed trapizonium crystals, based with lines of rhomboid crystalline fashion. It has the following chemical consistence $Pb_2 Cl_2 O_2 \frac{1}{2}$ or $2 Pb Cl$. In these scories or slags are found also, sometimes, phogenite crystals. Laurionite is lately discovered and described by Professors Köchling and Rath.

6). LITHARGE OF THE ANCIENTS is found in small quantities with the scories or slags of the Ecvolades.

7). ANCIENT CLAY (old slimes).—Containing 10-12 % lead and 1500—1800 grs. of silver (ounces 47—57) per ton of lead. It is the product of the ancient Ore washing rooms, and as such it is either smelted with the scories or slags directly, or made into bricks mixed with the product of the Ore dressing rooms of the moderns.

8), YELLOW ECVOLADES.—Waste heaps of the old silver mines containing 5—6 % lead and 1300—1500 grs. of silver (ounces 41—47) per ton of lead. In that state they are taken to the ore dressing rooms to be washed and prepared, where if richer they are smelted without preparation.

9). ECVOLADES SOURIZA.—Waste washing-room heaps of metallic Ore containing 3. 5—4 % of lead and 3000—3500 grs. (ounces 96—112) of silver per ton of lead. These are taken to be washed and prepared at

the Ore dressing factory of the company. — The Greek Metallurgical company of Laurium possess the largest Ore dressing rooms in Europe. Untill 1891 she had in use a large Ore dressing factory for washing Ecvolades. But on account of the lack of crushing machines and suitable machinery for washing the slimes, the heaps which were produced by the Ore dressing rooms of the moderns, were thrown away as useless though they still contained about 3—3.5 % of lead, and 1500-1800 grs. (ounces 47—57) of silver per ton of lead, and slimes of the moderns, containing 4.5-6 % lead and 2000-2500 grs. of silver (ounces 64—80) per ton of lead.

Therefore in order to overcome this difficulty and to utilize that which was thrown away untill now as useless, though still containing in large quantities these mineral substances, the Company resolved to erect an other Ore dressing factory of vast power and extent which can wash 1000—1200 tons of the said substances per day. This new Ore dressing house having percussion tables with india-rubber sheets, and general machinery of the latest and most perfect kind for the needs, and by the already acquired experience of the employeès of the company, affords excellent results, from which we produce:

10). SAND.—Product of the sieve gigger (Cribles), containing 20—23 % of lead and 2500—4300 grs. (ounces 80—38) of silver.

11), FINE SAND (or Slimes).—Product of the percuss-

ion elastic (india-rubber) tables, contains also 20-23 % of lead and 2000—2800 grs. (ounces 64—90) of silver per ton of lead.

12). FINE SLIMES.—These they gather into cess-pool's outside the Ore dressing factory, and contain 5—6 % lead of which each ton contains 1500—1800 grs. of silver (ounces 47—57).

These products containing lead, most part of which is oxide of lead nonsulphurous, are smelted in the blast furnaces without any preceding roasting. Previously though, they are made by machinery into:

13). BRICKS. Containing 10—11 % of lead and 2500 grs. of silver (ounces 80) per ton of lead, as also iron flux (fondant) according to the various needs.

14). ARSENICAL UNROASTED FUMES. — The furnace fumes are carried away in a stone built flue, about 1200 metres long and 9 □ metres in section (about 10,800 cub. metres). Inside this flue the fumes are condensed and falling afterwards, they are gathered and resmelted. They contain 30—38 % of lead and 100—120 grs. of silver (ounces 3, 2—3, 8) per ton of lead; also 30—35 % of arsenic (As_2O_3). The yearly product of this fume varies between 3000 to 3500 tons. Formely the fume was smelted directly with other metals in blast furnaces (cylindrical). Three years ago the roasting of the leaden fumes before smelting, was considered more advantageous and the metallic loss was less. These roastings are done inside reverberatory furnaces, and

they yield from the one hand arsenic inseparate flues, sold in the markets of Europe, and on the other :

15). ROASTED LEAD-FUME.—Containing 50—55 % lead and 100—105 grs. silver (ounces 3, 2-3, 4) and 5-7 % arsenic, and resmelted in the furnaces.

16). IRON ORE OF MAGANEZE.—The Company exploits a thick and extensive bed of Maganeze iron Ore, combined in many parts with Galena, Cerusite (white lead ore). The obtained metal, selected by hand, produces: on one side iron Ore of Maganeze, containing 35—38 % iron, and 15—18 % maganeze, and is sent to European and American iron foundries; and on the other :

17). MAGANEZE IRON ORE AND LEAD.—Containing 5-7 % lead and 1500—2200 grs. of silver (ounces 47—70) per ton of lead, as also 28-30 % of iron and 10-12 maganeze. This lead Ore sometimes is brought into the Ore dressing house of the Company to separate the lead from the iron, and at other times is sent directly to the blast furnaces.

18). ARGENTIFEROUS-LEAD.—The aforementioned lead-en metals, that is the ancient scories or slags, the products of the Ore dressing rooms, the fumes, and the iron flux, mixed suitably, are smelted in 14 cylindrical blast furnaces, producing annually 8000 tons of lead, containing 2500—2600 grs. (ounces 80—84) silver per ton. This silver lead bears the impressed type «ΕΛΛΑΣ» and is sold in the markets of England, and a small quantity in Germany and Italy.

19). SPEISS.—Every year as a second product of the smelting, is produced 1200—1500 tons of Speiss, which contains 3 % lead with 400 grs of silver (ounces 12), 56 % iron, 24 % arsenic and 3—5 % Copper. Of this product a small quantity only is sold annually, the rest is kept at the stores of the Company, for the purpose of extracting the copper, the arsenic and the silver-lead out of it.

20). SOFT LEAD.—About 500 tons from the annual produce of hard silver-lead the Company transforms into soft lead, extracting the silver by Zincage and separating the other metals by steam. This soft lead is used entirely in this country, serving for the construction of lead pipes and hunting shots of the industry of the country. It bears the type ΑΑΥΡΙΟΝ. These new processes of Desilverization were added by the Company to their works, about three years ago.

21). SMITHSONITE. This is found in griffons of minerals passing through the limestone. It contains 30-36 % of oxide of zinc before being roasted ; it is transported to the Metallurgical works of the company where it is calcinated in cylindrical furnaces, and yields oxide of zinc (45-48 %) which is sent to the markets of Europe.

22). BROWN COAL (Lignite). — This mineral coal is found in thick beds, inside the eocene system at Oropo which is about 5 hours far from Athens. At the Metallurgical works, it is used for roasting the Smithsonite

Ore, and feeding the reverberatory furnaces. Also it is used to heat the boilers for the steam Engines, being mixed with English coal.

The chemical consistence of the above exhibits appears in the following index.

[illegible]

Laurium 5 Janary 1893.

*The General Manager of the Greek
Metallurgical company of Laurium (Usines du Laurium)*

A. CORDELLAS





